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PATENT
Atty. Dkt. No. APPM/4666/ETCH/CHMBR

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Mohn, et al.

Serial No.: 09/611,817 — Group Art Unit: 1763

Confirmation No.: 6787 — Examiner: Anna M. Crowell

Filed: July 7, 2000

For: Multi-Purpose Processing Chamber With Removable Chamber Liner

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
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37 CFR 1.8
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3/22/04 (Date) — Kevin R. Zubr (Signature)

Dear Sir:

APPEAL BRIEF

Applicants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1763 dated December 29, 2003, finally rejecting claims 1-11, 13-15, 21, 24, 25 and 34-36. Please charge the fee of $330.00 for filing this brief to Deposit Account No. 20-0782/APPM/4666/KMT. **Three copies of this brief are submitted for use by the Board.**

Real Party in Interest

The present application has been assigned to Applied Materials, Inc., 3050 Bowers Avenue, Santa Clara, California 95054.

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Related Appeals and Interferences

Applicants assert that no other appeals or interferences are known to the Applicants, the Applicants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

Status of Claims

Claims 1-11, 13-15, 21, 24-25, and 34-36 are pending in the application. Claims 1-33 were originally presented in the application. Claims 12, 16-20, 22-23, and 26-33 have been canceled. Claims 1-11, 13-15, 21, 24-25, and 34-36 stand rejected in view of several references as discussed below. The rejection of claims 1-4, 11, 13-15, 21 and 24-25 is appealed. The pending claims are shown in the attached Appendix.

Status of Amendments

The claims in the Appendix include amendments filed subsequent to the Final Office Action dated September 30, 2003. Applicants proposed amendments to claims 11, 21, 24-25 in a response dated November 21, 2003. In an Advisory Action dated December 29, 2003, the Examiner indicated that the proposed amendments would be entered upon appeal. The arguments presented after final rejection were not accepted by the Examiner.

Summary of Invention

The present invention generally provides a multi-purpose chamber for a variety of applications including deposition and etch processes. The chamber may provide uniform plasma confinement around a substrate in the chamber and efficient and uniform exhaust of processing gas from the chamber. One aspect of the invention comprises a chamber body 202 with an internal volume defined by first and second substantially cylindrical regions 204A and 204B and by side walls 204C extending between the first and second cylindrical regions. A substrate support 216 is located in the internal volume within the first substantially cylindrical region 204A, and an exhaust system 210 is connected to a chamber outlet 208 in fluid communication with the second cylindrical region 204B. (See pages 6 to 8, Figure 3).

The chamber body 202 may receive a variety of chamber liners or inserts 250 to conduct etch and deposition processes. The various inserts 250 are shaped to define advantageous interior chamber designs for specific processes. The various inserts 250 define a process region surrounding substrate support surface 218, an exhaust region 208, and a passage region between the process region surrounding substrate support surface 218 and the exhaust region 208. The various inserts 250 are fitted to a fixed chamber body 202. Hence, to modify the size or shape of the process region 218, the exhaust region 208, or the passage region, one need only replace the various inserts 250. Additionally, the passage region may include traps to prevent plasma escaping from the process region into the passage or exhaust regions. (See pages 9 to 11, Figure 3).

Issues Presented

1. Whether the Examiner erred in rejecting claims 1-4, 13-15, and 24-25 under 35 U.S.C. §112 second paragraph as being unpatentable.

2. Whether the Examiner erred in rejecting claim 1 under 35 U.S.C. §102(b) as being unpatentable over *Tepman, et al.*

3. Whether the Examiner erred in rejecting claims 2-4 under 35 U.S.C. §103(a) as being unpatentable over *Tepman, et al.* in view of *Benjamin, et al.*

4. Whether the Examiner erred in rejecting claims 11, 13-15, 21, and 24-25 under 35 U.S.C. 103(a) as being unpatentable over *Tepman, et al.* in view of *Shan, et al.*

Grouping of Claims

Pending claims 1-4, 11, 13-15, 21 and 24-25, do not stand or fall together for all arguments presented by Applicants. Applicants' first argument relates to the first issue for claims 1-4, 13-15, and 24-25 and claim 1 is representative of the claims. Applicants' second argument relates to the second issue for claim 1. Applicants' third argument relates to the third issue for claims 2-4 and claim 2 is representative of the claims. Applicants' fourth argument relates to the fourth issue for claims 11, 13-15, 21, and 24-25 and claim 11 is the representative claim.

ARGUMENT

I. THE EXAMINER ERRED IN REJECTING CLAIMS 1-4, 13-15, AND 24-25 UNDER 35 U.S.C. §112 SECOND PARAGRAPH BECAUSE THE CLAIMS CLEARLY DESCRIBE THE INTERNAL VOLUME OF A CHAMBER.

The Examiner holds the phrase "substantially tangent" is unclear when used to describe how sidewall 204C is nearly tangent to both the first and second substantially cylindrical regions 204A and 204B. The Examiner also holds that it may be unclear as to what degree sidewall 204C is substantially tangent. The Examiner asserts that to be tangent to both of the cylindrical regions 204A and 204B, the sidewall 204C must touch the surface of each cylindrical region in a single point.

The independent claims specifically describe a "chamber body having an internal volume defined by first and second substantially cylindrical regions and by side walls extending substantially tangent between the first and second substantially cylindrical regions." This chamber body as described by claim 1 and the other independent claims is defined by the inner surfaces of the sidewalls which are substantially tangent to the inner surfaces of the cylindrical regions.

Applicants use the term substantially tangent in reference to definition of an inner volume. Only the inner surfaces of the side walls and cylindrical regions define the inner volume. Two cylinders are tangent in exactly two planes. Thus, two substantially tangent side walls have inner surfaces that are substantially tangent to the cylindrical regions.

The Examiner errs in asserting that the inner volume can also be defined by the outer surfaces of the side walls and cylindrical regions because the outer surfaces do not define the inner volume. Reversal of the rejection is respectfully requested.

II. THE EXAMINER ERRED IN REJECTING CLAIM 1 UNDER 35 U.S.C. §102(B) AS BEING UNPATENTABLE OVER *TEPMAN, ET AL.* BECAUSE THE CLAIMS DEFINE AN INTERIOR VOLUME NOT TAUGHT OR SUGGESTED BY THE REFERENCES.

Claim 1 stands rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,730,801 (*Tepman, et al.*) The Examiner asserted in the second office action that *Tepman, et al.* discloses an apparatus for processing wafers including a chamber body with an internal volume that includes two cylindrical regions (14, 36); one cylindrical region that contains a substrate support (36), and another cylindrical region in fluid communication with an exhaust system. The Examiner also held that the claimed apparatus does not define structurally over *Tepman, et al.*

Tepman, et al. teaches a chamber with two cylindrical regions and side walls having outer surfaces that are somewhat tangent. The inner surfaces of the side wall described by *Tepman, et al.* are not substantially tangent and appear to be parallel in the drawings.

The position taken by the Examiner erroneously ignores the Applicants' claim language which specifies that the configuration of the side walls and cylindrical regions defines an inner volume. The language of claim 1 specifies that the inner volume is defined by substantially tangent side walls. *Tepman, et al.* does not describe or suggest an inner volume defined by substantially tangent side walls. Reversal of the rejection is respectfully requested.

III. THE EXAMINER ERRED IN REJECTING CLAIMS 2-4 UNDER 35 U.S.C. §103(A) AS BEING UNPATENTABLE OVER *TEPMAN, ET AL.* IN VIEW OF *BENJAMIN, ET AL.* BECAUSE THE REFERENCES DO NOT TEACH OR SUGGEST THE INTERNAL VOLUME RECITED IN THE CLAIMS.

Claims 2-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Tepman, et al.* in view of U.S. Patent No. 5,820,723 (*Benjamin, et al.*). The Examiner holds that *Tepman, et al.* discloses an RIE type arrangement for the processing region (14) in a preferred embodiment, but the processing region is not limited to this arrangement (col. 5, lines 57-63). *Benjamin, et al.* teaches that it is conventional to generate plasma in the processing chamber using an inductive-coupling arrangement wherein a flat, inductive coil is disposed on the top wall of the chamber. The examiner asserts it would have been obvious to provide an inductive-coupling arrangement for the processing region of *Tepman, et al.* because it would have been obvious to substitute

one conventional plasma-generating arrangement for another. In such an arrangement, a flat coil would be placed on top of the cover (or lid 28) of *Tepman, et al.*'s enclosure and the cover would be made of quartz and flat on top as taught by *Benjamin, et al.*.

Claims 2-4 depend on claim 1. The chamber body of claim 1 is defined by the internal volume of the processing regions and the connecting side walls. The *Tepman, et al.* and *Benjamin, et al.* references, combined or individually, do not teach, show, or suggest a chamber body having an internal volume defined by first and second substantially cylindrical regions and by side walls extending substantially tangent between the first and second substantially cylindrical regions as described in claim 1. Reversal of the rejection is respectfully requested.

IV. THE EXAMINER ERRED IN REJECTING CLAIMS 11, 13-15, 21, AND 24-25 UNDER 35 U.S.C. §103(A) AS BEING UNPATENTABLE OVER *TEPMAN, ET AL.* IN VIEW OF *SHAN, ET AL.* BECAUSE *TEPMAN, ET AL.* DOES NOT TEACH OR SUGGEST A LINER IN AN INTERNAL VOLUME DEFINED BY THE STRAIGHT AND SUBSTANTIALLY TANGENT SIDE WALLS.

Claims 11, 13-15, 21, and 24-25 as amended stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Tepman, et al.* in view of European Patent No. 0814495 (*Shen, et al.*). The Examiner asserts it would have been obvious to provide liners to the cylindrical regions of *Tepman, et al.*, as taught by *Shan, et al.* The Examiner further asserts it would have been obvious to provide a plasma confinement flange, a barrier flange, and cylindrical regions with relative diameters to the apparatus of *Tepman, et al. Tepman, et al.* further discloses that the processing region defined by the first compartment 12 in base 20 is readily removed for cleaning. (*See*, col. 5, line 63, to col. 6, line 6, and Fig. 1). *Shan, et al.* discloses shields 10, 12, 13, 14, 40, 42 and exhaust baffle 14 within a single cylindrical region. The single cylindrical region of *Shan, et al.* comprises a cylindrical processing region atop an annular exhaust region, separated by the exhaust baffle.

The claim amendments submitted in the response to the final office action were entered by the Examiner. Hence, claims 11 and 21 are independent claims that now include, "the internal volume is defined by first and second substantially cylindrical

regions and by straight side walls substantially tangent to the first and second substantially cylindrical regions." Claims 13-15 and 24-25 are dependent on 11 and 21. Thus, the independent claims define the regions protected by a liner by focusing on the internal volume of the chamber.

The Examiner noted in the second office action that *Tepman, et al.* fails to teach one or more chamber liners, a plasma confinement flange, and a barrier flange. Moreover, *Tepman, et al.* does not teach an internal volume defined by straight side walls that are substantially tangent to cylindrical regions.

Shan, et al. discloses shields and baffles within a single cylindrical region. The stacked, vertical processing and exhaust schemes of *Shan, et al.* preclude a continuous liner that is in communication with multiple regions. *Shan, et al.*'s shields and baffles are not continuous, they do not include the processing region, an exhaust region, and a region to connect the processing region and the exhaust region.

The Examiner asserts no motivation for combining the shields of *Shan, et al.*'s single cylindrical region to the two cylindrical regions of *Tepman, et al.* and of the present invention. Furthermore, the removable base 20 of *Tepman, et al.* can be removed and cleaned like the shields and exhaust baffle of *Shan, et al.*. Therefore, persons skilled in the art would have no motivation to insert liners in the removable base 20 of *Tepman, et al.*

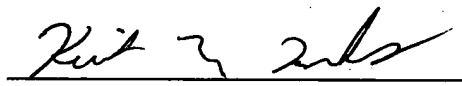
Tepman, et al. and *Shan, et al.,* alone or in combination, do not teach, show, or suggest a chamber body having an internal volume, wherein the internal volume is defined by first and second substantially cylindrical regions and by straight side walls substantially tangent to the first and second substantially cylindrical regions, one or more liners defining within the internal volume a substantially cylindrical processing region within the first substantially cylindrical region and a substantially cylindrical exhaust region within the second substantially cylindrical region, wherein the substantially cylindrical processing region communicates with the substantially cylindrical exhaust region through one or more openings defined by the one or more liners, a substrate support disposed in the substantially cylindrical processing region, and an exhaust system in communication with the substantially cylindrical exhaust

region through an exhaust port in the process chamber, as recited in claim 11, and claims dependent thereon. Applicants respectfully request reversal of the rejection.

Conclusion

Tepman, et al., Shan, et al., and *Benjamin, et al.*, alone or in combination, do not teach, show, or suggest an internal volume defined by first and second substantially cylindrical regions and by side walls substantially tangent to the first and second substantially cylindrical regions. Therefore, the rejections made by the Examiner should be reversed. Thus, Applicants respectfully request reversal of the rejection and allowance of claims 1-4, 11, 13-15, 21, and 24-25.

Respectfully submitted,



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APPENDIX

1. (Previously Presented) An apparatus for processing a semiconductor substrate, comprising:

a chamber body having an internal volume defined by first and second substantially cylindrical regions and by side walls extending substantially tangent between the first and second substantially cylindrical regions;

a substrate support disposed in the internal volume within the first substantially cylindrical region; and

an exhaust system connected to a chamber outlet disposed in fluid communication with the second substantially cylindrical region.

2. (Previously Presented) The apparatus of claim 1, further comprising:

a chamber lid mounted on the chamber body; and

an electrode disposed on the chamber lid.

3. (Original) The apparatus of claim 2, wherein the electrode comprises one or more inductive coils.

4. (Original) The apparatus of claim 2, wherein the electrode comprises one or more flat coils.

5. (Previously Presented) An apparatus for processing a semiconductor substrate, comprising:

a chamber body having an internal volume defined by first and second substantially cylindrical regions and by side walls extending between the first and second substantially cylindrical regions, a substrate support disposed in the internal volume within the first substantially cylindrical region;

an exhaust system connected to a chamber outlet disposed in fluid communication with the second substantially cylindrical region; and

one or more chamber liners defining a substantially cylindrical processing region adjacent the substrate support and an exhaust region adjacent the chamber outlet.

6. (Original) The apparatus of claim 5, wherein the substantially cylindrical processing region is in fluid communication with the exhaust region through a passage defined by the liner.

7. (Original) The apparatus of claim 6, wherein the liner further comprises a plasma confinement flange extending inwardly around the substrate support.

8. (Original) The apparatus of claim 7, wherein the substrate support further comprises a barrier flange surrounding the substrate support.

9. (Previously Presented) The apparatus of claim 5, wherein the first substantially cylindrical region has a first diameter at least 30% larger than a second diameter of the second substantially cylindrical region.

10. (Previously Presented) The apparatus of claim 5, wherein the first substantially cylindrical region has a first diameter at least 20% larger than a substrate support diameter.

11. (Previously Presented) An apparatus for processing a substrate, comprising:

a chamber body having an internal volume, wherein the internal volume is defined by first and second substantially cylindrical regions and by straight side walls substantially tangent to the first and second substantially cylindrical regions;

one or more liners defining within the internal volume a substantially cylindrical processing region within the first substantially cylindrical region and a substantially cylindrical exhaust region within the second substantially cylindrical region, wherein the substantially cylindrical processing region communicates with the substantially cylindrical exhaust region through one or more openings defined by the one or more liners;

a substrate support disposed in the substantially cylindrical processing region; and

an exhaust system in communication with the substantially cylindrical exhaust region through an exhaust port in the process chamber.

13. (Previously Presented) The apparatus of claim 11, wherein the first substantially cylindrical region is parallel to the second substantially cylindrical region.

14. (Previously Presented) The apparatus of claim 13, wherein the first substantially cylindrical region has a first diameter at least 30% larger than a second diameter of the second substantially cylindrical region.

15. (Previously Presented) The apparatus of claim 13, wherein the first substantially cylindrical region has a first diameter at least 20% larger than a substrate support diameter.

21. (Previously Presented) An apparatus for processing a substrate, comprising:

a chamber body comprising an internal volume and an exhaust port, wherein the internal volume is defined by at least first and second substantially cylindrical regions and by straight side walls substantially tangent to the first and second substantially cylindrical regions;

one or more liners defining an exhaust region and a processing region within the internal volume, wherein the exhaust region is co-axial with the exhaust port and the processing region is on a parallel axis with the exhaust region, and wherein the one or more liners define the processing region in the first substantially cylindrical region and define the exhaust region in the second substantially cylindrical region; and

a substrate support disposed in the processing region.

24. (Previously Presented) The apparatus of claim 21, wherein the first substantially cylindrical region has a first diameter at least 30% larger than a second diameter of the second cylindrical region.

25. (Previously Presented) The apparatus of claim 21, wherein the first substantially cylindrical region has a first diameter at least 20% larger than a substrate support diameter.

34. (Previously Presented) The apparatus of claim 5, further comprising:
a chamber lid mounted on the chamber body; and
an electrode disposed on the chamber lid.

35. (Previously Presented) The apparatus of claim 34, wherein the electrode comprises one or more inductive coils.

36. (Previously Presented) The apparatus of claim 34, wherein the electrode comprises one or more flat coils.